SUPPLEMENTAL MATERIAL

Contents

Detailed Documentation of Community Risks Estimates Located.

Table S-1 provides detailed summary descriptions of the all the studies containing estimates of the effect of smoking restriction laws that were located for this study.

Average Smoking Prevalence in Study Sites

The most specific regional estimate available was used; ranging from the national prevalence (Scotland and Ireland) to a specific municipality (Saskatoon, Canada). The overall prevalence was used for Saskatoon, since gender-specific estimates were unavailable. Standard errors were not available European countries, and were calculated by multiplying the country estimate by the relative standard error for the pooled estimate from areas with sufficient data. We used the pooled random effects average for the data in Table S-2

Risk of AMI in Recent Quitters

Appropriate values for the relative risk of recent quitters, R_q, and current smokers, R_c, are not available in the literature. The appropriate value of R_q for recent quitters is calculated from existing estimates of the decline in relative risk due to smoking as a function of time since quitting. The average relative risk of current smokers for the community, R_c, is calculated from sex and age specific rates, then adjusted for all adult smokers in the community. Both relative risks must also be adjusted for change in referent groups, from never smokers to all non-smokers (Table S-3). These adjustments are explained below. The parameter distributions used and subsidiary calculations are shown in Tables S-2 to S-4.

The relative risks of quitters of current smokers and recent quitters, with never-smokers as the referent group, are modeled using estimates for 18 to 64 year old smokers from Lightwood and Glantz:[4]

$$\ln R^*_{c,s}(n) = \ln[\{(R^*_{c,m} + R^*_{c,f}F) - (R^*_{\infty,m} + R^*_{\infty,f}F)\}\exp(-n/\tau) + (R^*_{\infty,m} + R^*_{\infty,f}F)] \qquad \text{[S-1]}$$

where

$R^*_{c,s}(n)$ = relative risk for ex-smokers *n* months following cessation for sex *x*, using never smokers as the referent group

$R^*_{c,s}$ = relative risk of current smokers of sex *s*, using never smokers as the referent group,

$R^*_{\infty,s}$ = asymptotic limit of the relative risk of smokers who of sex *s* (*m* = men, *f* = women) who have quit for *n* = infinity,

F = indicator variable for *s* = women,

τ =exponential rate of decay for relative risk expressed in months since cessation,

n = number of months since smoking cessation (n = 0 indicates current smoking),

and the asterisk (*) indicates that never-smokers are the reference group.

Note that $R^*_{c,s}(0)$ is defined as the relative risk of current smokers (that is, "ex-smokers" at zero months following cessation and is equal to the parameter $R^*_{c,s}$. The notation $R^*_{c,s}(12)$ is an the relative risk for an ex-smoker at after twelve months of cessation.

The distributions of $R^*_{c,s}(n)$ from equation [S-1] is simulated using the regression parameter coefficients and the Cholesky decomposition of the variance-covariance matrix (Table S-4) because of significant correlation between the parameter estimates.

A constant flow of recent quitters are assumed to quit smoking at the beginning of period a, after the ban, and continues for one year, n = 12. The effect of recent quitting is modeled by multiplying the cumulative percentage of recent quitters, p_q, by the average relative risk of quitters by the average relative risk of the flow of quitters. A midpoint correction is used to calculate the average relative risk of recent quitters:

$$R^*_{q,s} = [\, R^*_{c,s}(0) + R^*_{c,s}(12) \,] / 2, \qquad \text{[S-2]}$$

where

$R^*_{c,s}(0)$ = the relative risk of current smokers (that is "ex-smokers" with zero months cessation).

Equation [S-1] uses never smokers as a reference group for the individual relative risk for current and recent quitters, and the relative risks applies to adults age 18 to 64. The conversion is made to the referent group of all non-smokers and all adult age groups in three steps: combine

the sex specific relative risks to overall relative risks for all adults 18 to 64, convert the referent group from never smokers to all non-smokers (never and ex-smokers), and finally, adjust the overall relative risk for 18 to 84 year olds to apply to all adults over age 18.

The overall relative risks for current smoking were calculated from smoking population weighted sex-specific relative risks equal to the population weighted sex specific proportion of current smoking:

$$R_c^* = [p_{b,c,m} R_{c,m}^* + p_{b,c,f} R_{c,f}^*] / (p_{b,c,m} + p_{b,c,f}) \quad \text{[S-3a]}$$

$$R_q^* = [p_{b,c,m} R_{q,m}^* + p_{b,c,f} R_{q,f}^*] / (p_{b,c,m} + p_{b,c,f}) \quad \text{[S-3b]}$$

where

$p_{b,c,s}$ = proportion of current smoking in sex *s* before the smoking law,

$R_{q,s}^*$ = average relative risk of recent quitters in sex *s* from adoption of law to 12 months after the law took effect (that is, *n* = 12 months),

The overall proportion of current and ex-smoking before the ban is equal to the population weighted sex specific proportion of current smoking:

$$p_{b,z} = p_{b,z,m} p_m + p_{b,z,f} (1 - p_m), \quad \text{[S-4]}$$

where

p_m is the proportion of men age 18 to 64 years old,

z is *c* for current smoking, and *f* for ex-smokers.

Data limitations prevent treatment of never and former smokers as distinct categories for analysis of passive smoking, so all non-smokers are used as the reference group. First the referent group is changed from never-smokers to all non-smokers who are not recent quitters (that is, anyone who has not quit due to the smoking ban). Therefore the relative risk for current

smokers age 18 to 64 is adjusted so that the reference group is all non-smokers. This conversion is done by dividing the average RR for both sexes (the weight average of sex specific relative risks for current and former smokers in equations [S-3a] and [S-3b], respectively) to the average RR of never-smokers for both sexes as the referent group, by dividing through by the smoking population weighted average relative risk of never and former smokers:

$$R_{c,adults} = R_c^* / R_{\sim c}\,, \qquad \text{[S-5a]}$$

$$R_q = R_q^* / R_{\sim c}\,, \qquad \text{[S-5b]}$$

where,

$R_{c,adults}$ = the relative risk for all adults age 18 to 64, using never-smokers as the reference group,

$R_{\sim c}$ = the average relative risk of all non-smokers of both sexes.

The relative risk of all non-smokers (never-smokers and ex-smokers), $R_{\sim c}$, is calculated using the relative risk of ex-smokers, population prevalence of current and ex-smokers, and male proportion of the population age 18-64:

$$R_{\sim c} = [(p_{b,x,m}/(1-p_{b,c,m}))p_m + (p_{b,x,f}/(1-p_{b,c,f}))(1-p_m)](1-R_x) + R_x\,, \qquad \text{[S-6]}$$

where

R_x = the relative risk of ex-smokers.

Conversion of relative risks of current smokers to all adults over 18. The relative risks for AMI from current smoking apply to adults age 18 to 64 is adjusted to apply to all adults over age 18. This adjustment is done by smoking population weighted average adjustment using the ratio of overall relative risk for adults age 18 to 64 and overall relative risk for those age 65 and over:

$$R_c = R_{c,adults}\,[p_{c,e}(R_{c,e}/R_{c,y}) + (1-p_{c,e})]\,, \qquad \text{[S-7]}$$

where

$R_{c,y}$ = overall relative risk of AMI from active smoking, adults age 18-64,

$R_{c,e}$ = overall relative risk of AMI from active smoking, adults age 65 and over,

$p_{c,e}$ = proportion of adult smokers age 65 and over.

The prevalence of smokers who are over age 65 were calculated from age-specific prevalence of smoking[42] and age distribution of the resident population of the U.S.[43] The data and resultant proportion of current smokers of age 65 and over are shown in Table S-5

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Table S-1. Summary of Studies of the Effects of Individual Studies on Changes in AMIs following Implementation of Smokefree Laws

Location	Effective Date / Study period Post/Pre duration (months)	End point	Ages	Measure ./ Statistical Method	Confounders	Risk		Exposure Change[g]	N (events)	Notes
						Observed	At 12 months[e]			
Italy[h] (4 regions)[24]	10 Jan 2005 Compared 10 Jan 2005 through 10 Mar 2005 (after law) with Jan-Mar for 2001-4 (during 4 years before law). Pre: 12 (over 4 years) Post: 2	AMI (ICD-9 410)	40-64	Age-standardized rates (European) Comparison of observed rate after law with expected value based on linear secular trend for same months during the 4 years before the law went into effect.	Age, gender, region	.86 (.83, .92) m: .85 (.81-.91) f: .98 (.87-1.11) 40-44: .98 (.82-1.19) 45-49: .77 (.68-.89) 55-59: .92 (.84-1.02) 60-64: .99 (.88-1.06)	.77 (.74, .82)	Small decreases in smoking prevalence (30.0 to 29.3% in men and 22.5% to 22.1% in women) and consumption (16.7 to 16.3 cig/day for men and 13.7 to 12.4 cig/day for women) led to 7.6% decline in cigarette consumption[44 45] Fewer than 100 violations in 6000 checks by police[45] 90-95% reduction in air nicotine in pubs and discos[46] 8.9% decline in cigarette sales in 2005[45]	7305	Effect largest among young men and people 45-54. Some regional variation.
Helena, MT[22]	Law in effect 6 months, from Jun 5 – Dec 3, 2002 Dec 1997 to Nov 2003 Post: 6 Pre: same 6 months for 4 pre years and 1 year after law suspended.	Primary and some secondary (validated with troponin or CPK) diagnosis of AMI (ICD-9 410)	All	Number of admissions during 6 month period the law was in effect compared to the average for the same 6 months in other yaers by Poisson test	Comparison with number of admissions from surrounding area (not covered by law)	.60 (.21, .99) No significant change in (control) area outside Helena	.56 (.20, .93)		304	No significant change in admission patterns from patients from surrounding area Analysis did not consider fact that admissions were increasing with time, which biases comparison toward null

Table S-1. Summary of Studies of the Effects of Individual Studies on Changes in AMIs following Implementation of Smokefree Laws (cont.)

Location	Effective Date / Study period Post/Pre duration (months)	End point	Ages	Measure ./ Statistical Method	Confounders	Risk		Exposure Change[g]	N (events)	Notes
						Observed	At 12 months[e]			
Piedmont, Italy[h] [12]	10 Jan 2005 Compared Oct-Dec 2004 (before law) and Feb-June 2005 (after all) with same periods 1 year earlier Post: 6 Pre: 3 (but see above)	AMI (ICD-9 410)	All	Age-standardized rates (European)	Age	<60: .89 (.81, .98) m: .91 (.82, 1.01) f: .75 (.58-.96) ≥ 60: 1.05 (1.00-1.11) m: 1.03 (.96-1.11) f: 1.05 (.91-1.11)	.83 (.76, .92)	See entry for Italy.	17,153	No changes from one year before for pre-law period; change compared to one year earlier for post-law period
Scotland [21]	Apr 2006 Jun 2005 to Mar 2007 Post: 10 Pre: 10	Acute coronary syndrome (detectable troponin after emergency admission for chest pain) (ICD-10 I21)	All	Chi-square and test for trend	Stratified on gender and age (men≤55; women≤65) Used data from England as historical control	.83 (.82, .84) significant downward time trend after law for detailed data by gender, age, smoking status, see Table 1 of their paper	.81 (.80, .84)	Percentage of people who had never smoked who reported no exposure to secondhand smoke increased from 57% to 78% (P<.001); there was a reduction in geometric mean serum cotinine from 0.68 to 0.56 ng/ml (P<.001).	5919	17% drop overall, 14% among smokers, 19% among former smokers, 21% among nonsmokers Larger risk reductions in older people
Massachusetts [20]	5 July 2004 5 July 1994 to 31 Dec 2006 Post: 18 Pre: 114 Risk estimate 12 months post state law[c]	Acute myocardial infarction	All	Regression		.82 (.76, .89)	.82 (.76, .89)	94% compliance with the law	NA	Much of state was already covered by strong local laws. No effect of state law when already strong local law.

Table S-1. Summary of Studies of the Effects of Individual Studies on Changes in AMIs following Implementation of Smokefree Laws (cont.)

Location	Effective Date / Study period Post/Pre duration (months)	End point	Ages	Measure ./ Statistical Method	Confounders	Risk		Exposure Change[g]	N (events)	Notes
						Observed	At 12 months[e]			
Saskatoon, Canada[19]	July 1, 2004 1 Jul 2000 to 30 June 2005 Post: 12 Pre: 48	AMI (ICD-10)	All	Incidence ratio and confidence interval post law compared to pre. Age-standardized AMI incidence rate	Age	.87 (.85, .93)	.87 (.85, .93)	914 of 924 eligible businesses establishments were inspected by a public health inspector within the first 6 months of the law; only 13 required an initial warning for non-sompliance. Re-inspection only required 1 citation being issued during the first year of the law. Smoking prevalence in Saskatoon fell from 24.1% in 2003 (95% CI 20.4-27.7) to 18.2% in 2005 (15.7-20.9); smoking in the rest of Saskatchewan Province (which includes Saskatoon) remained stable from 2003 to 2005 at 23.8% (22.6-25.3). One year after implementation (July 2005), 79% responded that the "smoking ban was a good idea."	1689	
Rome, Italy[h 14]	10 Jan 2005 Jan 2000 to Dec 2005 Post: 12 Pre: 48	Acute coronary events, including AMI (ICD-9 410) and "other acute and subacute forms of ischemic heart disease" (ICD-9 411). Cases were included with principal diagnosis of AMI or secondary diagnosis of AMI when principal diagnosis indicated AMI complications.[i] Out of hospital deaths from ischemic heart diseases (ICD-9 410-414) if no evidence of hospitalization for coronary causes in the previous 28 days or any cause in the last 2 days.	35-84	Age standardized rates (European) Poisson regression on number of daily events after 10 Jan 2005 compared to before Separate analyses done for out-of-hospital deaths and hospitalizations and an analysis of incident cases only.	Age, gender, PM_{10} air pollution, flu epidemics, holidays, temperature, secular trend, all-cause hospitalizations, socioeconomic status	35-64: .89 (.85, .93) 65-74: .92 (.88-.97)	.89 (.85, .93)	Prevalence of smoking decreased from 34.9% to 30.5% in men and from 20.6% to 20.4% in women. Cigarette sales decreased in Rome by 5.5% in 2005 compared to 2004. See also entry for Italy.	2136	No effect in 75-84 year olds. Protective effect of law seemed stronger in low SES areas.
Ireland[15]	29 March 2004 Post: 12 Pre: 12	Acute coronary syndrome	All	Poisson regression		.89 (.81, .97)	.89 (.81, .97)	Among bar workers, cotinine concentration fell by 69% and 74% reported reduced secondhand smoke exposure.[47]	~3300	Reduction maintained for additional 12 mos

Table S-1. Summary of Studies of the Effects of Individual Studies on Changes in AMIs following Implementation of Smokefree Laws (cont.)

Location	Effective Date / Study period Post/Pre duration (months)	End point	Ages	Measure ./ Statistical Method	Confounders	Risk		Exposure Change[g]	N (events)	Notes
						Observed	At 12 months[e]			
Pueblo, CO[13]	1 Jul 2003 Jan 2002 to Dec 2004 Post: 18 Pre: 18	Primary diagnosis of AMI (ICD-9 410) (Primary diagnosis only)	All	Poisson regression	Seasonality, population size Comparison with people living in surrounding Pueblo County (not covered by ordinance) and with nearly El Paso County (which did not have an ordinance)	.73 (.64, .82) [d] m: .75 (.61, .90) f: .70 (.53, .87)	.78 (.68, .88)	Adult smoking prevalence is Pueblo County (which includes the City) in 2002-3 was 25.9% (20.2, 31.6%) and in 2004-5 was 17.4% (14.5, 20.2%); for El Paso County in 2002-3 was 20.6% (15.4, 25.8%) and 2004-5 was 22.3% (19.3, 25.4%)	2794	No significant change in surrounding area (.85; .56, 1.14) or El Paso County (.96; ..87, 1.04) Assuming all fatal AMI's reached hospital reduced risk estimate to .82 (.64, .97)
New York State[17]	24 Jul 2003 Jan 1995 to Dec 2004 Post: 21 Pre: 99	AMI (ICD-9 410), primary diagnosis only	35+	Multiple regression time series	Age-adjusted (NY population in 2000) Existence of strong local ordinance, time (linear secular trend), seasonality, county	.8004 (..7985, .8023) (Juster, personal communication for Confidence Interval)	.886 (.894, .888)	After implementation of the state law, exposure to SHS declined by nearly 50%; saliva cotinine dropped from 0.078 to 0.041 ng/mL[30]	462,396	By 2002, 75% of New Yorkers were subject to strong local laws, as well as limited restrictions at the state level implemented in 1989 No sudden change with law; rate of decline in AMI admissions increased significantly over moderate or no local laws. Also considered primary diagnosis of stroke (ICD-9 430-438); no association of law with stroke
Bowling Green, OH[b 18]	Mar 2002 Jan 1999 to Jun 2005 Post: 34 Pre: 38	Coronary heart disease, including angina, heart failure, arteriosclerosis, and AMI (ICD-9 410-414, 428)	18+	Age-standardized rates ARIMA Ordinance effect assumed to start in Oct 2002	Comparison with control community (Kent, OH)	.61 (.55, .67) in 2003 (1 year later) .53 (.45, .59) in first half of 2005, (2.5 years later) No significant change in Kent (control) No differences in admissions for "no-smoking related	.78 (.71, .86)		NA	

						conditions (not specified)				
Pueblo, CO[11] Pooled Estimatef	Extend to Jun 2006 Post: 36 Pre: 18	Primary diagnosis of AMI (ICD-9 410) (Primary diagnosis only)	All	Comparison of rate ratios	Comparison with people living in surrounding Pueblo County (not covered by ordinance) and with nearly El Paso County (which did not have an ordinance)	.59 (.49, .70) m: .67 (.52, .82) f: .48 (.36, .60) .81 (.78, .85)	.77 (.64, .92) .83 (.80, .87)		4954 (1559 added)	No significant change in surrounding area (1.03; .68, 1.39) or El Paso County (.95; .87, 1.03) Assuming all fatal AMI's reached hospital reduced risk estimate to .66 (.55, .77)

Table S-1. Summary of Studies of the Effects of Individual Studies on Changes in AMIs following Implementation of Smokefree Laws (cont.)

Location	Effective Date / Study period Post/Pre duration (months)	End point	Ages	Measure ./ Statistical Method	Confounders	Risk		Exposure Change[g]	N (events)	Notes
						Observed	At 12 months[e]			
Not included in meta-analysis due to incomplete information										
Monroe County, IN[23]	1 Aug 2003, bars added 1 Jan 2005 Aug 2001 to May 2003 compared with Aug 2003 to May 2005 Post: 22 Pre: 22	Acute myocardial infarction (ICD-9 410), confirmed with troponin or CPK excluding past cardiac procedures, no cardiac risk factors (e.g., hypertension or hypercholesteromenia)	All	Poisson test	Compared with Delaware County (no law)	Significant drop in number of nonsmokers admitted in Monroe County, but not Delaware County (control). No change in number of smokers admitted.			56	Bar provisions only in effect for last 5 months of post period. There was a 48% reduction in AMIs between pre and post period (nonsmokers and smokers combined). No RR or CI available. Unrealistically stringent exclusionary criteria
France[16]	1 Feb 2007, restaurants, bars, casinos added 1 Jan 2008 Jan 2006 to 15 Feb 2008 Post: 1.5 (full implementation)	Acute myocardial infarction	All	Rate per 100,000 admissions		Age $\leq$ 65: .85 Age $\geq$ 66: .88		Between Jan 2007 (before law) and Jan 2008 (after law) SHS exposure dropped from 57% to 14%. $PM_{2.5}$ levels dropped.	NA	Also report substantial drops in respiratory symptoms <<slide 47 ff>>

	Pre: 24									

[a] Includes outdoor areas of restaurants and bars
[b] Excludes bars
[c] Pooled estimate of Weak local law (.82; .73, .87) and No local law (.83; .69, .99) (fixed effects meta-analysis; risk estimates homogeneous)
[d] Updated results[11]
[e] RR and confidence intervals adjusted to 12 months using lnRR12 = lnRR + 0.0113 (Post – 12)
[f] Random effects meta-analysis
[g] In some cases, there are more studies of changes in exposure. Those listed here are typical. If no citation is included in this column, the results are from the AMI study.
[h] Smoking allowed in separately ventilated public rooms with doors maintained under negative pressure. Few businesses are willing to incur this expense to maintain smoking.
[i] ICD-9 427.1, 427.41, 427.42, 427.5, 428.1, 429.5, 429.6, 429.71, 429.79, 429.81, 518.4, 780.2, 785.5, 414.10, 423.0.

Table S-2. Prevalence of current smoking among adults

Area of smoking law study	men		women		Source
	prevalence	SE	prevalence	SE	
Helena Montana	0.204	0.015306	0.222	0.0132	CDC[35]
Pueblo Colorado	0.205	0.011735	0.194	0.00918	CDC[35]
Piedmont Italy	0.314	0.0163600	0.176	0.008707	OECD[34]
Bowling Green Ohio	0.204	0.014796	0.265	0.0112	CDC[35]
New York State	0.19	0.011224	0.188	0.00816	CDC[35]
Ireland	0.28	0.018312	0.26	0.0170	OECD[34]
Saskatoon Canada	0.234	0.015306	0.234	0.0153	Shields[36]
Rome Italy	0.314	0.0163600	0.176	0.008707	OECD[34]
Glasgow	0.25	0.01635	0.23	.011379	Scottish Government Statistics[48]
Massachusetts	0.20	0.01204	0.174	0.007143	CDC[35]

Table S-3. Parameter distributions used in subsidiary calculations

Parameters	Mean (95% CI)	Distribution	Source
Relative risk, current smokers, all adults age 18-64, $R_{c,y}$	3.53 (3.21, 3.85)	normal	Teo KK 2006[49]
Relative risk, current smokers, all elderly, $R_{c,e}$	2.55 (2.34, 2.76)	normal	Teo KK 2006[49]
Relative risk, ex-smokers, all adults, R_x	1.49 (1.39, 1.59)	normal	Teo KK 2006[49]
current smokers, adult men, before ban, $p_{b,c,m}$	0.239 (0.211,0.267)	normal	CDC State Tobacco Activities Tracking and Evaluation (STATE) System,[26] Shields,[36] OECD Health Data 2007.[34]
current smokers, adult women, before ban, $p_{b,c,f}$	0.211 (0.190,0.231)	normal	CDC State Tobacco Activities Tracking and Evaluation (STATE) System, [26]Shields, [36] ECD Health Data 2007.[34]
ex-smokers, adult men, before ban, $p_{b,x,m}$	0.259 (0.251,0.267)	normal	CDC State Tobacco Activities Tracking and Evaluation (STATE) System[26]
ex-smokers, adult women, before ban, $p_{b,x,f}$	0.184 (0.177,0.191)	normal	CDC State Tobacco Activities Tracking and Evaluation (STATE) System[26]
Proportion of adult population, men, p_m	0.498	constant	resident population, Census Bureau[43]
Proportion of smokers who are elderly, p_{ce}	0.07	constant	resident population, Census Bureau[50]; MMWR 2005[42] (See Table S-4)

Table S-4. Regression parameters and variance-covariance matrix for relative risks of current smoking and quitting						
Active Smoking Relative Risk Variables						
Variable	Mean		Covariance	Matrix		
		$R_{c,\,m}$	$R_{c,\,f}$	$R_{\infty,\,m}$	$R_{\infty,\,f}$	τ
$R^*_{c,\,m}$	2.881	0.09927	-0.07451	0.0006320	0.01129	-1.010
$R^*_{c,\,f}$	0.9719	-0.07451	0.1139	0.002037	-0.007080	0.2175
$R^*_{\infty,\,m}$	1.166	0.0006320	0.002037	0.01783	-0.01204	-0.2391
$R^*_{\infty,\,f}$	0.2304	0.01129	-0.007080	-0.01204	0.02859	-0.4739
τ	19.10	-1.010	0.2175	-0.2391	-0.4739	56.13
Source: Lightwood and Glantz[4]						

Table S-5.—Calculation of proportion of current smokers who are elderly			
age group	resident population	prevalence of current smoking smoking	current smoking smokers
18-24 years old	28,889,168	0.260	7511184
25-44 years old	84,216,990	0.284	23917625
45-64 years old	68,646,935	0.234	16063383
> 64 years old	35,957,792	0.101	3631737
total			51123929
proportion elderly among smokers			0.071
Source: Population Division US Census Bureau. Annual Estimates of the Population by Selected Age Groups and Sex for the United States: April 1, 2000 to July 1, 2006[42]			

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